CLINICAL SCIENCE

Factors associated with medicine use and self medication are different in adolescents

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OBJECTIVE: To estimate the prevalence of medicine use among high school students (14-18 years old) living in an urban area in Southern Brazil and the proportion who self-medicate and to explore the association between medicine use and demographic, socioeconomic, and behavioral variables.

METHODS: A school-based survey was conducted among high school students in the city of Maringá/PR, Brazil in 2007. The sample students were selected through two-stage random sampling. The sample included 991 students (54.5% females) from eight public and four private high schools. The data were collected using a structured questionnaire. Only medications used within the 15 days preceding data collection were considered. The independent variables studied were sex, age, socioeconomic status, living with parents, employment status, smoking habits, and alcohol use.

RESULTS: The prevalence of medicine use among the adolescents was 55.8% (females = 64.3%, males = 45.7%, $p<0.001$) and 52.6% of this use represented self medication (females = 51.0%, males = 56.8, $p = 0.21$). The factors associated with medicine use were age, employment, and smoking, while the factors associated with self medication were male gender and employment. Chronic users did not tend to self-medicate.

CONCLUSION: The data from this study demonstrate a high prevalence of medicine use and self medication; however, the variables associated with medicine use and self medication differed. Urgent strategies to promote the rational use of drugs in this population and their families are necessary.

KEYWORDS: Adolescents; Drug Utilization; Risk Factor; Cross-Sectional Study; Developing Countries.

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INTRODUCTION

Recent studies have demonstrated that adolescents present several risk behaviors,[1] among which the most prevalent are physical inactivity,[2] poor nutrition habits,[3] smoking,[4] and alcohol abuse.[5]

The main causes of mortality and morbidity among adolescents in both industrialized and developing countries are limited primarily to a relatively small number of preventable health-risk behaviors often initiated in early adolescence.[1,5]

A range of health problems have been associated with participation in risk behaviors[6,7] that may lead this population to use medications. Medicine consumption has become a major concern in society, and epidemiological research on medicine use is especially relevant for the development of appropriate and successful public health policies for preventing substance abuse.[7-9]

However, medication consumption is multi-factorial, and few studies have investigated the prevalence of medicine use,[9,10] the proportion of self medication[11] and the risk factors associated with such behavior in this population.

Therefore, the aims of this study were the following: a) to estimate the prevalence of medicine use and proportion of self medication among high school students (14-18 years old) living in an urban area in Southern Brazil; and b) to explore the association of medicine use with demographic, socioeconomic, and behavioral variables.

METHODS

A cross-sectional, school-based survey was conducted in the city of Maringá, which has 326,000 inhabitants and is located in the northwestern state of Paraná, Southern Brazil. The city's human development index (HDI) is high (0.84, as compared to an overall HDI for Brazil of 0.79).[12]

After having received a formal request and information on the study's importance, objectives, and methodology, the

board of each selected school granted consent for this study be conducted.

Sample Size

The population included adolescents from 14 to 18 years old of both sexes enrolled in public or private high schools in Maringá, PR in 2007. The populations of both public and private schools were included in the sample. The data were obtained from the Paraná State Department of Education and the Union of Private Schools of Maringá-PR.[13]

Sample size calculations were performed. The parameters included a confidence interval of 95%, a power of 80% and a 50% prevalence as most the expected outcome, with margin of error 5 percentage points and a design effect of 2 because it was considered to be a complex sample. Based on these parameters, it was estimated that data from at least 734 adolescents needed be collected. Because this study was part of a larger health survey including other outcomes that required larger samples, an extra 10% for possible losses and refusals and an extra 15% for multivariate analysis were added, resulting in a minimum sample requirement of 918 subjects. This sample size allowed detecting a prevalence ratio of 1.2 as statistically significant at the 5% level and with an 80% power for a 50% prevalence exposure by age.

The sample was obtained via a classroom selection process that was divided into two stages: school categories (primary sampling unit), and classrooms. The schools were classified into two categories: public and private. In the first stage, in which eight public and four private schools were selected, the schools were randomly selected with respect to the proportional probability of the population in each high school stratum. In the second stage, the classrooms were selected by random sampling; their number was proportional to the population of students in each grade (10th through the 12th grade).

Variables

The data were collected in the classrooms by a team of four interviewers, all of whom had at least graduated from high school and had trained for 40 h prior to the data collection. Two pilot studies were performed with a one-week interval between them at schools not part of the final sample. We used the kappa coefficient to verify the agreement and reproducibility of the questionnaires in both studies. The observed agreement was high (k = 0.91). The fieldwork began in August 2007 and ended in October 2007, which corresponded to from the end of winter until mid-spring.

Only medications used in the 15 days prior to the data collection were considered in the outcome. Accordingly, medicine use was verified using a structured questionnaire about the 15 days preceding the date of the data collection: ''Within the previous 15 days, did you fail to take any medication?'' If the adolescent had taken any medicine, he or she was asked ''Who recommended the treatment?'' The options included doctor (current prescription), doctor

Table 1 - The unadjusted prevalence (%) of medicine use and the adjusted prevalence ratio (PR) and 95% confidence interval (CI95%) according to the independent variables. Maringá – Brazil (2007).

Level[a]	Variables	n	Medicine use					
			%	*p*-value	Unadjusted analysis		Adjusted analysis	
					PR ($CI_{95\%}$)	*p*-value	PR ($CI_{95\%}$)	*p*-value[b]
1	**Sex**			<0.001‡		<0.001‡		<0.001‡
	Male	451	45.7		0.71 (0.63-0.80)		0.69 (0.61-0.78)	
	Female	540	64.3		1.00		1.00	
	Age (years)			0.069†		0.054†		0.011†
	14	86	50.0		1.00		1.00	
	15	286	52.5		1.04 (0.82-1.33)		1.05 (0.82-1.33)	
	16	368	57.6		1.15 (0.91-1.44)		1.12 (0.89-1.42)	
	17+18	251	59.0		1.17 (0.93-1.49)		1.24 (1.01-1.57)	
	Living with parents			0. 487‡		0. 502‡		0.403‡
	Yes	899	56.1		1.00		1.00	
	No*	92	53.3		0.95 (0.77-1.16)		0.92 (0.75-1.11)	
2	**Socioeconomic status**			0. 116†		0.082†		0.136†
	A (richest)	140	64.3		1.24 (0.94-1.63)		1.30 (0.98-1.71)	
	B	521	55.7		1.07 (0.83-1.39)		1.12 (0.86-1.45)	
	C	270	52.8		1.01 (0.77-1.33)		1.03 (0.78-1.35)	
	D+E (poorest)	60	51.7		1.00		1.00	
	Employment			0.035‡		0.047‡		0.004‡
	No	797	54.3		1.00		1.00	
	Yes	194	61.9		1.13 (1.01-1.29)		1.21 (1.06-1.38)	
3	**Smoking**			0.045‡		0.019‡		0. 036‡
	No	934	55.0		1.00		1.00	
	Yes	57	68.4		1.24 (1.03-1.49)		1.20 (1.01-1.43)	
	Alcohol use			0. 526‡		0.523‡		0.97‡
	No	711	57.1		1.00		1.00	
	Yes	280	55.2		1.03 (0.91-1.16)		1.00 (0.89-1.12)	
	Total	991	55.6					

*- other options included grandparents, alone, hostel, husband and/or wife.
‡- Wald test for heterogeneity.
†- Wald test for trend.
a – The effect of each variable on the outcome is adjusted for other variables in the same level or above in the hierarchical model.
b – Variables with $p>0.2$ were excluded from the model.

(old prescription), self medication (over-the-counter), family/friends or drugstore employee. Other questions included ''Are you familiar with the medicine you are using?'' (yes or no), ''Did the medicine have a yellow stripe (indicating a generic formulation)?'' (yes, no or I do not know) and ''Why are you using the medicine?'' (for temporary/occasional health problems or chronic health problems). It was important for us to determine the rate of generic medicine use in adolescents because they are considered to be reliable in Brazil. Federal law requires that a generic medicine contain the same quality, measurable composition and bioequivalence of its brand name equivalent, and this is ensured by bioavailability studies. All recommendations from family, friends or drugstore employees (over-the-counter medications) were considered to be self medication.

Any physician-prescribed medications that were either not purchased or not taken were also considered self medication. Although Brazilian law stipulates that physicians are the only professionals qualified to prescribe drugs, the same law requires an on-duty pharmacist at each pharmacy during operating hours. The pharmacist's role is to give the patient advice on how and when to take their medicine, along with analysis and verification of drug interactions and side effects.

The independent variables included in this investigation were sex, age, socioeconomic status (the Brazil Criterion of Economic Classification, which divides families into five groups with ''A'' as the wealthiest),[14] living with parents (yes or no), employment (yes or no), smoking habits (including cigarettes, cigarillos and cigars) and alcohol use (including beer, wine, and liquor).

Statistical Analyses

The data were entered twice into an Epi-Info database with automatic checks for consistency and range. The data cleaning and analyses were conducted using the Stata 8.0 software (STATA Corp., College Station, TX, USA). Initially, we analyzed the proportion of adolescent medicine use according to each independent variable. Adjusted analyses were calculated using a Poisson regression with robust variance adjustment, the recommended approach for high-prevalence outcomes,[15] with a confidence interval of 95% (CI95%) calculated for the prevalence ratio (PR). The adjusted analysis was performed according to a hierarchical framework that had been previously divided into three levels: 1) sex, age, and socioeconomic status; 2) living with parents and employment; and 3) alcohol and tobacco use. The variables were included in the model by levels, with the higher levels first.[16] The significance level for a variable to be retained in the model was set at $p<0.20$. The Wald test for heterogeneity was used to determine the significance level (5% alpha) of the dichotomous variables, and the linear trend was used for ordinal categorical variables. Subsequently, the same analysis was performed for the other information about medicine use. All the analyses were adjusted for the clustered nature of the sample using the ''svy'' set of commands in Stata.

Human Subject Approval Statement

This study was approved by the Ethics Committee on Research Involving Human Participants of University Center of Maringá and authorized by the Ethics Committee on Research Projects of the University of São Paulo's Clinical Hospital in accordance with Brazilian laws. All of the students from the selected groups present on the day of data collection were considered eligible to participate in the study after their parents or guardians had given written consent in addition to the students' verbal consent.

RESULTS

The number of adolescents selected from public and private schools were 774 and 492, respectively. The loss of potential subjects, including those who refused to participate, was anticipated in the research planning and fell within the projected parameters for the sample size. The total loss was 275, 92 of whom were absent on the day of data collection (76.1% from public schools, n = 70) and 183 of whom either did not deliver the consent form or refused to participate in the research (82% from private schools, n = 150). Thus, the final sample consisted of 991 high school students, 67.7% of whom were from public schools (n = 671).

Table 1 presents the unadjusted and adjusted prevalences of the outcome (medicine use) according to the independent variables. The results showed a high prevalence of medicine use in the 15 days prior to the interview, with females representing a higher proportion than males ($p = 0.0001$). The risk factors included paid employment and smoking. Furthermore, age presented a positive and significant linear trend ($p = 0.0001$). The other independent variables were not statistically significant.

Table 2 - The prevalence (%) of reasons for (chronic and occasional) medicine use within the prior 15 days among adolescents in Maringá – Brazil (2007), according to the independent variables.

Variables	n	% Reason for use		
		eventual	chronic	*p*-value
Sex				0.020‡
Male	205	80.0	20.0	
Female	346	70.8	29.2	
Age (years)				0.173†
14	43	81.4	18.6	
15	149	79.2	20.8	
16	211	72.5	27.5	
17+18	148	69.6	30.4	
Living with parents				0.389‡
Yes	503	74.7	25.3	
No*	48	68.7	31.3	
Socioeconomic status				0.152†
A (richest)	90	64.4	35.6	
B	289	76.5	23.5	
C	141	75.2	24.8	
D+E (poorest)	31	77.4	22.6	
Employment				0.346‡
No	431	75.2	24.8	
Yes	120	70.8	29.2	
Smoking				0.019‡
No	512	73.8	26.2	
Yes	39	64.1	35.9	
Alcohol use				0. 449‡
No	369	74.5	25.5	
Yes	182	73.6	26.4	
Total	551	74.2	25.8	

*- others options included grandparents, alone, hostel, husband and/or wife.
‡- Wald test for heterogeneity.
†- Wald test for trend.

The prevalence ratio (chronic or occasional) of medicine use is described in Table 2. Occasional use was more prevalent than chronic use. About 1/3 of the employed, smoking adolescents reported chronic medicine use, which was statistically significant ($p = 0.019$). However, higher proportions of occasional use were observed in the highest socioeconomic group (A) and among those not living with their parents, although this was not statistically significant.

The vast majority of the adolescents who had used medication in the last 15 days did not know the name/s of their medication/s; among females, this number was even higher ($p<0.001$) than among males. As shown in Table 3, we observed that non-smoking adolescents and those who chronically used drugs knew their medicine's name with greater frequency than smokers and those who used drugs occasionally ($p = 0.02$ and 0.004, respectively).

The adolescents who used medication for chronic problems confirmed the presence of the yellow stripe (indicating a generic medication) more frequently than those who only used medications for occasional problems (39.4% and 37.9%, respectively, $p = 0.001$). However, occasional users understood the meaning of the yellow stripe on the packaging less frequently (52.1%, $p = 0.001$).

The prevalence of self medication among the adolescents was high, and more than half (52.6%) did not have a prescription (i.e., they used medication based solely on what they thought was best or on recommendations from family, friends or pharmacy employees). It was also observed that adolescents who lived with their parents and were employed had higher levels of self medication ($p = 0.001$ and $p = 0.0001$, respectively) and that chronic users showed a lower proportion of self medication than occasional users.

Table 4 presents the prevalence of medicine use according to having a prescription and its association with the independent variables. Self medication had the highest prevalence. Unemployed adolescents who lived with their parents had a higher prevalence of self medication; the medications used by employed adolescents who did not live with their parents were more frequently prescribed.

The self-medication prevalence and the unadjusted and adjusted associations among the independent variables are presented in Table 5. The data indicated a high proportion of adolescents participating in this risky behavior; more than half of the sample used medicine. Self medication was strongly associated with employed male adolescents and with adolescents living with their parents.

The association between the reason for medicine use (occasional or chronic) and seeking a physician's advice (current prescription, old prescription and self medication) is presented in Figure 1-A. It was observed that 60% of the adolescents who used medication for occasional health

Table 3 - The prevalence of not knowing the medication's name among adolescents using medications within the prior 15 days in Maringá – Brazil (2007), according to the independent variables.

Variables	n	no knowledge of the name	
		%	*p*-value
Sex			<0.001‡
Male	205	67.8	
Female	346	85.0	
Age (years)			0.034†
14	43	69.8	
15	149	79.2	
16	211	74.8	
17+18	148	85.8	
Living with parents			0.141‡
Yes	503	77.7	
No*	48	87.5	
Socioeconomic status			0.129†
A (richest)	90	86.7	
B	289	78.2	
C	141	73.8	
D+E (poorest)	31	80.7	
Employment			0.532‡
No	431	78.0	
Yes	120	80.8	
Smoking			0.027‡
No	512	77.5	
Yes	39	92.3	
Alcohol use			0.112‡
No	369	80.2	
Yes	182	75.3	
Pattern of use			0.003‡
Eventual	409	75.6	
Chronic	142	87.3	
Total	551	78.6	

*- other options included grandparents, alone, hostel, husband and/or wife.
‡- Wald test for heterogeneity.
†- Wald test for trend.

Table 4 - The association with the independent variables and the prevalence (%) of medicine use among adolescents who used medicine within the prior 15 days in Maringá – Brazil (2007), according to the characteristics of the prescription.

Variables	n	Prescription			
		Current	old	self medication	*p*-value
Sex					0.23‡
Male	206	33.5	9.7	56.8	
Female	347	42.1	6.7	51.1	
Age (years)					0.45†
14	43	48.8	9.3	41.9	
15	150	36.0	10.0	54.0	
16	212	35.9	7.6	56.7	
17 e 18	148	43.2	6.1	50.7	
Live at household					0.001‡
Parents	504	38.1	7.9	54.0	
Others*	49	46.9	8.2	44.9	
Socioeconomic level					0.32†
A (richest)	31	47.8	6.7	45.5	
B	90	36.6	7.9	55.5	
C	290	40.1	7.8	52.2	
D+E (poorest)	142	29.0	12.9	58.1	
Employment					<0.001†
No	120	25.8	11.7	62.5	
Yes	433	42.6	6.9	50.5	
Smoking				0.0	0.21‡
No	514	39.3	8.4	52.4	
Yes	39	33.3	2.6	64.2	
Alcohol use					0.11‡
No	371	38.5	10.2	51.2	
Yes	182	39.6	3.3	57.0	
Total medicine use	553	38.9	8	52.6	

*- other options included grandparents, alone, hostel, husband and/or wife.
‡- Fisher Chi-square test with Yates' correction.
†- Mantel-Haenszel Chi-square test.

Table 5 - The prevalence (%) of medicine use, the unadjusted and the adjusted prevalence ratios (PR) and the 95% confidence intervals ($CI_{95\%}$) for adolescents who used medicine within the prior 15 days in Maringá – Brazil (2007), according to the independent variables.

Level[a]	Variables	n	Self medication					
			%	*p*-value	Unadjusted analysis		Adjusted analysis	
					PR ($CI_{95\%}$)	p-value	PR ($CI_{95\%}$)	*p*-value[b]
1	**Sex**			0.026‡		0.022‡		0.02‡
	Male	205	57.2		1.16 (1.02-1.30)		1.16 (1.01-1.32)	
	Female	346	66.8		1.00		1.00	
	Age (years)			0.158†		0.195†		0.737†
	14	43	51.2		1.00		1.00	
	15	149	63.8		1.29 (0.88-1.89)		1.31 (0.89-1.93)	
	16	211	64.5		1.35 (0.93-1.96)		1.39 (0.96-2.02)	
	17+18	148	55.4		1.21 (0.82-1.78)		1.23 (0.83-1.81)	
	Living with parents			0.196‡		0.239‡		0.280‡
	Yes	503	61.6		1.00		1.00	
	No*	48	52.1		0.83 (0.60-1.14)		0.82 (0.60-1.13)	
2	**Socioeconomic status**			0.168†		0.172†		0.994†
	A (richest)	90	52.2		0.74 (0.53-1.14)		0.80 (0.54-1.17)	
	B	289	63.3		0.95 (0.69-1.31)		0.98 (0.71-1.36)	
	C	141	58.9		0.89 (0.63-1.25)		0.92 (0.65-1.30)	
	D+E (poorest)	31	71.0		1.00		1.00	
	Employment			0.001‡		<0.001‡		<0.001‡
	No	431	57.1		1.00		1.00	
	Yes	120	74.2		1.23 (1.04-1.46)		1.21 (1.01-1.44)	
3	**Smoking**			0.436‡		0.402‡		0.577‡
	No	512	60.4		1.00		1.00	
	Yes	39	66.7		1.22 (0.95-1.57)		1.17 (0.91-1.51)	
	Alcohol use			0.904‡		0. 904‡		0.908‡
	No	369	61.0		1.00		1.00	
	Yes	182	60.4		1.11 (0.95-1.30)		1.10 (0.93-1.29)	
4	**Reason for use**			<0.001‡		<0.001‡		<0.001‡
	Eventual	409	67.5		1.00		1.00	
	Chronic	142	41.6		0.33 (0.22-0.50)		0.34 (0.22-0.58)	
	Total	551	60.8					

*- other options included grandparents, alone, hostel, husband and/or wife.
‡- Wald test for heterogeneity.
†- Wald test for trend.
a – The effect of each variable on the outcome is adjusted for other variables in the same level or above in the hierarchical model.
b – Variables with $p>0.2$ were excluded from the model.

problems self-medicated. However, only 20% of the adolescents who continuously used medications (due to chronic conditions) had a medical prescription, with old prescriptions being in the minority. When we analyzed self medication in isolation, we noticed that most of the recommendations for occasional use were made by family or friends; we also observed that pharmacy employees contributed significantly to the practice of self medication (Figure 1-B). Most of the medications for chronic use were recommended by a pharmacist; the adolescents did not report self-recommending chronically used medications.

DISCUSSION

An important limitation of this study is that it was not possible to accurately determine which adolescents had actually taken medication within the prior 15 days because the two pilot studies found that the students could not remember which medications they had used, if any. Despite such inconsistencies, we emphasize that the purpose of our research was to *estimate* the prevalence of medication use in the 15 days preceding the interview; this prevalence was high among the high school students, with more than half having used some type of medication. Upon analyzing the available literature, we found that the prevalence of medication use varied; our results were similar to those of some studies[17] and either higher[9] or lower than others.[10] Such disagreement may be explained by differences in the period investigated, including a week in one Brazilian study[9] and 30 days in another.[10] There has been no discernible pattern in the recall periods studied. These results are worrisome, and it is likely that the profusion of pharmacies, ''domestic pharmacies''[17] and even access to medications at school are linked to this high prevalence.

Our data corroborate other results in the literature[18,19] that show a higher proportion of females using medication than males. We also found that females less frequently remember the name of their medication(s). The reason for this difference may be that females look for professional medical advice more often than do males[19] and thus may have less personal stake involved in the choice of medication.

Although this variable has been little studied by other authors, the adolescents who participated in this study showed little knowledge about the names of the medications they were taking. Almost 80% of the adolescents did not know the name of a medication they had used in the prior 15 days. This result highlights the associated risk because most of the adolescents also self medicated. Increasing age, employment, smoking, and medication

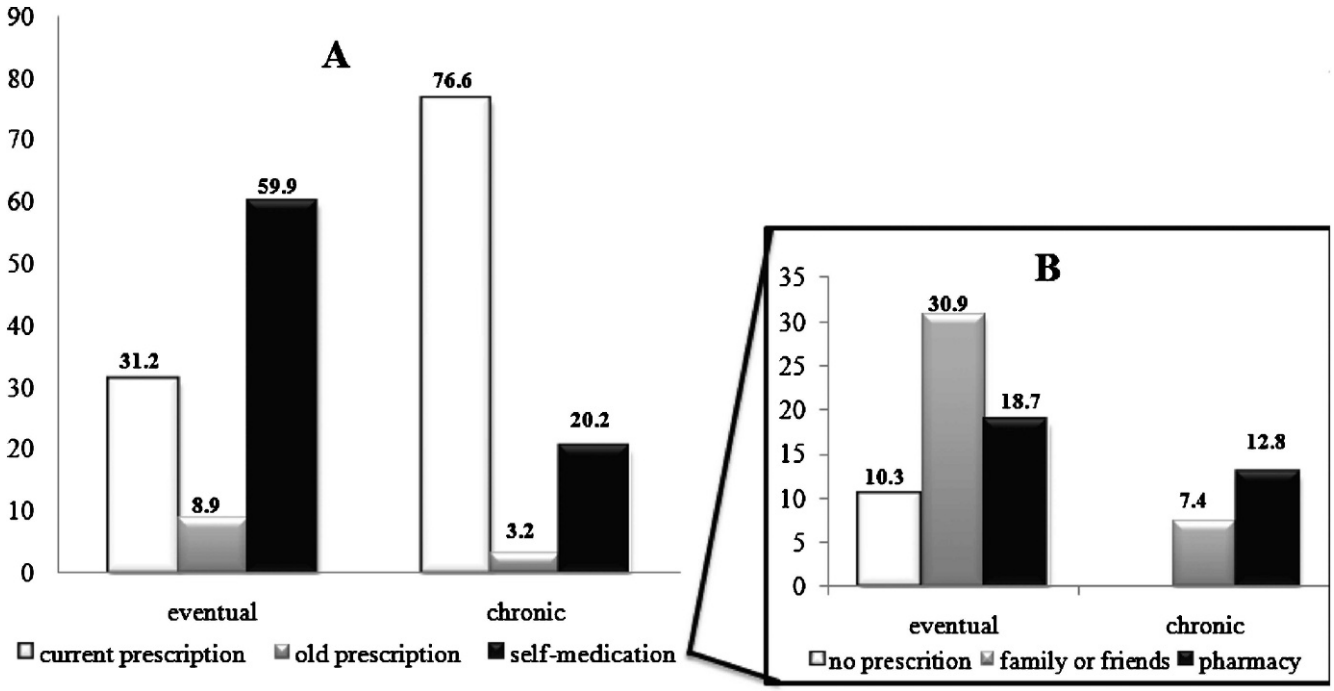

Figure 1 - A: The prevalence of the reason for medication use (occasional or chronic) and seeking a physician's advice (current prescription, old prescription and self-medication); **B**: The prevalence of whose recommendations prevail when adolescents self-medicate (Maringá/PR – Brazil, 2007).

consumption for chronic problems were related to ignorance of medication names. These data show that maturity is apparently not associated with better health care, especially given the observation that the adolescents who worked or who had one risk behavior also tended to have others.[1]

The important risk factors associated with medicine use included employment and smoking. The adolescents who worked had a greater susceptibility to health problems than their peers who do not work, including sleep disturbances and work-related exposure to both physical and burden (see Fischer et al),[20] which may cause more frequent medicine use in this subgroup.

The adolescents who smoked were more likely to use medicine. Furthermore, it was observed that the adolescents who smoked used medications mostly for occasional problems. Recent studies have shown a positive association between smoking and occasional medicine use,[8] indicating that tobacco causes harm to health both chronically[7] and acutely.[21]

Despite the population being aware that generic medications are lower priced and equal in quality to name-brands, their use has been much lower than expected.[22] This was also observed in our study, in which less than 40% of the adolescents reported the yellow stripe on their medicine packaging (indicating generic medicine). However, this result may be linked to the population not knowing how to identify a generic medication.[22] Most of the adolescents who used a generic medicine to treat chronic health problems did so because of its lower price.

As has been previously observed,[17,23] a high prevalence of self medication was observed in this age group. A study in Porto Alegre/RS (Southern Brazil) showed that almost 80% of those who practiced self medication were influenced by lay people,[23] with the vast majority being recommended by friends or family members, and that self medication was associated with occasional use. There are indications that self medication is associated with stocks of medicine in the home,[27] which can facilitate this risk behavior because most medicine used to self-medicate are for health problems. Another factor that may explain the high prevalence of self medication is the possibility that some adolescents may buy non-prescription drugs such as antacids, laxatives, vitamin or electrolyte supplements, analgesics, non-steroidal topical anti-inflammatory agents, etc. Surveys have demonstrated that antipyretic and anti-inflammatory drugs are most frequently used for self medication by adolescents.[11]

When the adolescents used medications for chronic conditions, 60% were purchased on the advice of pharmacists. Thus, we see that pharmacies have enabled self medication, and shop assistants and pharmacists have been acting as medication prescribers.[23] It is worth mentioning that pharmacists are of paramount importance in reducing the risks of self medication in this population.

In summary, the prevalence of medicine use among adolescents is high and is associated with socio-demographic variables and smoking. However, self medication and heeding recommendations from family and/or friends were associated with employment and the reason for use, indicating a need for better control of medication sales. These results suggest an urgent need to develop educational strategies for this population that promote the rational use of medicine and provide greater adherence to other healthy behaviors, such as tobacco abstinence.

IMPLICATIONS FOR SCHOOL HEALTH

Of all the medications used, more than 50% were not prescribed by physicians, meaning that the adolescents were self-medicating. Our findings reinforce the urgent

need for a public policy aiming at promoting healthy interventions and for strategies that prevent and/or minimize the need for medication use so that only medications prescribed by physicians will be used, especially in the adolescent school environment.

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